408. Proposed by EMMA M. GIBSON, Drury College.

Show that if n is a positive integer, the sum of the series

$$1 - \frac{2n-1}{1!} + \frac{(2n-1)(2n-2)}{2!} - \cdots + (-1)^{n-1}\frac{(2n-1)(2n-2)\cdots(n+1)}{(n-1)!}$$

is

$$\frac{(-1)^{n-1}(2n-2)(2n-3)\cdots(n+1)n}{(n-1)!}.$$

[From C. Smith's *Treatise on Algebra.*]

409. Proposed by C. E. GITHENS, Wheeling, W. Va.

Find integral values for the edges of a rectangular parallelopiped so that its diagonal shall be rational.

410. Proposed by C. N. SCHMALL, New York City.

Solve the simultaneous equations,

$$x^2 + xy + y^2 = a,$$

$$x^4 + x^2y^2 + y^4 = b.$$

411. Proposed by V. M. SPUNAR, Chicago, Illinois.

Determine $x_1, x_2, x_3, \cdots x_p$, from the equations

$$\begin{aligned} x_1 + x_2 + x_3 + \cdots + x_p &= a_0 \\ b_1x_1 + b_2x_2 + b_3x_3 + \cdots + b_px_p &= a_1 \\ b_1^2x_1 + b_2^2x_2 + b_3^2x_3 + \cdots + b_p^2x_p &= a_2 \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \\ b_1^{p-1}x_1 + b_2^{p-1}x_2 + b_3^{p-1}x_3 + \cdots + b_p^{p-1}x_p &= a_{p-1}. \end{aligned}$$

412. Proposed by H. L. SLOBIN, University of Minnesota.

Form the algebraic equation whose roots are: $a_1 = \cos\frac{\pi}{9}$, $a_2 = -\cos\frac{2\pi}{9}$, $a_3 = -\cos\frac{4\pi}{9}$. (See article in this issue, page 113.)

GEOMETRY.

When this issue was made up, solutions had been received for 431, 434 and 435. Solutions of 430, 432 and 436 are desired.

Those interested in 427 may add to the footnote attached thereto in the January issue the following reference: *Das Problem der Kreisteilung*, von A. Mitzscherling, Leipzig and Berlin, 1913.

437. Proposed by J. BROOKS SMITH, Hampden-Sidney, Va.

Let D, E, F be three arbitrary points taken on the sides of a triangle ABC. If Δ and Δ' be the areas of the triangles ABC and DEF, show that

$$\frac{\Delta'}{\Delta} = \frac{AF\cdot BD\cdot CE + AE\cdot CD\cdot BF}{abc},$$

the sign of each factor being determined as follows: Each segment adjacent to one of the vertices of the triangle ABC is to be regarded as positive or negative according as it is drawn towards or from the other vertex on the side containing the segment.

438. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.

By means of the theorem that the product of the diagonals of a quadrilateral inscribed in a circle is equal to the sum of the two products of pairs of opposite sides, obtain the usual formulæ for $\sin(\alpha \pm \beta)$ and $\cos(\alpha \pm \beta)$ in terms of $\sin\alpha$, $\sin\beta$, $\cos\alpha$, $\cos\beta$ (Godfrey and Siddon's *Geometry*, page 82).

439. Proposed by CHARLES N. SCHMALL, New York City.

Show that the areas of any two triangles circumscribed about the same circle are in the same ratio as their perimeters.

440. Proposed by W. L. WATSON, Moundsville, West Va.

A solid sector is cut out of a sphere 10 feet in radius by a cone whose vertical angle is 120°. Find the radius of the sphere whose volume is equal to that of the sector.

CALCULUS.

When this issue was made up, solutions had been received for 344-5-6-7, 349, 351, 354, 356, 357, and 358. Solutions of 332, 337, 340, 342, 348, 350, 352, and 353 are desired. A complete solution of 339 is also desired.

359. Proposed by W. D. CAIRNS, Oberlin College.

Examine for maxima and minima

$$f(x) = e^{-cx}(1 + \cos x) \quad (c > 0).$$

360. Proposed by ELMER SCHUYLER, Brooklyn, New York.

What interpretation must be given to

$$\frac{d^{1/2}y}{dx^{1/2}} \text{ so that } \frac{d^{1/2}}{dx^{1/2}}\left(\frac{d^{1/2}y}{dx^{1/2}}\right) = \frac{dy}{dx}?$$

361. Proposed by EMMA M. GIBSON, Drury College.

Determine the system of curves satisfying the differential equation

$$[(1 + x^2)^{1/2} + ny]dx + [(1 + y^2)^{1/2} + nx]dy = 0,$$

and show that the curve which passes through the point $(0, n)$ contains as part of itself the conic

$$x^2 + y^2 + 2xy(1 + n^2)^{1/2} = n^2.$$

(From Forsyth's *Differential Equations*, p. 41.)

362. Proposed by C. N. SCHMALL, New York City.

Having given $y^3 - a^2y + axy - x^3 = 0$, show by Maclaurin's theorem that

$$y = -\frac{x^3}{a^2} - \frac{x^4}{a^3} - \frac{x^5}{a^4} - \cdots.$$

MECHANICS.

When this issue was made up, solutions had been received for 273, 284-5, 288, and 289. Solutions of 266, 268, 269, 271, 274-5, 277, 279, and 286 are desired.

290. Proposed by B. F. FINKEL, Drury College.

A fox, pursued by a hound, is running with uniform velocity over a frail arch in the form of a cycloid; the hound stops at a weak point of the arch, then tumbles through and reaches the level ground with a velocity equal to that of the fox. Prove that the fox exerted no normal pressure on the arch at the point where the hound fell through.

(From Walton's *Problems in Theoretical Mechanics*, p. 605.)

291. Proposed by EMMA M. GIBSON, Drury College.

The time of descent, down a rough inclined plane, of a spherical shell which contains a smooth solid sphere of the same material as itself is t_1. The time of descent, down the same plane, of a solid sphere of the same material and radius as the shell is t_2. Determine the thickness of the shell.

From Loudon's *Elementary Theory of Rigid Dynamics*, p. 188.